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CLAIMS

1. Device for measuring the relative orientation of at least a first object with respect to a second object free from said first object, or connected to it but with independent movement, wherein said orientation is carried out according to at least one degree of freedom comprising:

- 5           - at least one goniometric sensor for said or each degree of freedom suitable for measuring the variation of orientation in a plane;
- 10          - at least one constraint generator for said or each goniometric sensor for causing the latter to move in said plane;

**characterised in that**

15         said or each constraint generator being a flexible elongated element having a longitudinal axis with a low flexional stiffness in a first plane passing through the said axis and a high flexional stiffness in a second plane orthogonal to said first plane and passing through 20 the said axis, whereby said element is flexible only in said first plane.

2. Device, according to claim 1, wherein said constraint generator has high stiffness to torsion and to tensile stress.

25 3. Device, according to claim 1, wherein said or each goniometric sensor is located in a housing that crosses longitudinally said constraint generator, said goniometric sensor measuring the relative angular movement of said objects in a bending plane of said

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constraint generator.

4. Device, according to claim 1, wherein said or each constraint generator has a plurality of substantially parallel portions having larger cross section alternated to a plurality of portions with smaller cross section, whereby such smaller cross sections confer to the structure a big flexional capacity in a plane and in the meantime a big flexional stiffness in a plane orthogonal to it, as well as a big stiffness to torsion and to tensile stress.
5. Device, according to claim 1, wherein said or each constraint generator is an plate shaped element from which projections extend substantially bellow-like.
6. Device, according to claim 5, wherein said bellow-like projections have structure chosen among: helical; alternated annular portions having larger and smaller cross section.
7. Device, according to claim 1, wherein said constraint generator has flanges orthogonal to said axis for fastening at its ends more constraint generators 1 in series or for fastening to the objects whose rotation must be detected.
8. Device according to claim 1, wherein said goniometric sensor comprises:
  25. a flexible elongated element that extends between a first and a second object, said element having a neutral axis, which does not change its own length when bending, and at least one fibre spaced apart from said neutral

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axis and that extends from said first to said second object;

- means for measuring the length variation of said fibre as the relative rotation varies between said first and said second object, said relative rotation being proportional to said length variation.

9. Device for measuring the relative orientation of a first object capable of rotating about more axes independent with respect to a second object  
10 **characterised in that** it comprises a plurality of constraint generators, according to claims from 1 to 7, connected rigidly in series at the ends, and in particular a constraint generator for each axis of rotation or rotational degree of freedom, said constraint generators being oriented according to the different flexion planes, so that each sensor present in the corresponding constraint generator measures the bending in a different plane, said relative rotational movement of said first object with respect to said second object being determined by means of a combination of measures of angular movements in each flexion plane.

10. Device for measuring the rotation of the arm with respect to the shoulder of an individual  
25 **characterised in that** it comprises three constraint generators, according to claims from 1 to 8, arranged in series associated to three goniometric sensors, wherein the first constraint generator has a free end integral to the shoulder and is oriented for bending

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in a first plane, the second constraint generator in a second plane orthogonal to the first and the third constraint generator in a third plane orthogonal to the second and having the free end integral to said  
5 arm.

11. Device for measuring the rotation of the forearm with respect to the arm of an individual **characterised in that** it comprises a constraint generator and a relative goniometric sensor, according to claims from  
10 1 to 8, with an end integral to the arm and the other end integral to the forearm.

12. Device for measuring the rotation of the wrist of an individual with respect to a point of the arm, which point during the rotation of the wrist remaining substantially fixed, **characterised in that** it comprises at least one goniometric sensor according to claim 8 arranged with an end integral to the wrist and with the other end constrained to said fixed point, said goniometric sensor measuring the rotation of the  
15 wrist with respect to said second point of the arm.  
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13. Data suit for measuring the angular rotation of the arm with respect to the shoulder, of the forearm and of the wrist with respect to the arm of an individual **characterised in that** it comprises:

- 25 - a device for measuring the rotation of the arm with respect to the shoulder according to claim 10;  
- a device for measuring the rotation of the forearm with respect to the arm, according to claim 11, arranged orthogonally to said device for measuring the

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rotation of the arm with respect to the shoulder;  
- a device for measuring the rotation of the wrist,  
comprising at least one goniometric sensor according  
to claim 12, arranged with an end integral to the  
wrist and with the other end constrained to said fixed  
point, said goniometric sensor measuring the rotation  
of the wrist with respect to said second point of the  
arm.

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